

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 126 934 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
26.03.2003 Bulletin 2003/13

(51) Int Cl.7: **B21C 47/00**, B21C 47/24,
B21C 47/32, B65H 67/04,
B21C 47/06

(21) Application number: **99949295.2**

(86) International application number:
PCT/IB99/01758

(22) Date of filing: **01.11.1999**

(87) International publication number:
WO 00/025951 (11.05.2000 Gazette 2000/19)

(54) **COILING MACHINE FOR ROLLED STOCK**
WICKELMASCHINE FÜR WALZGUT
MACHINE DE BOBINAGE POUR MATERIAU LAMINE

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE

- **DE LUCA, Andrea**
I-33047 Remanzacco (IT)
- **POLONI, Alfredo**
I-34070 Fogliano di Redipuglia (IT)

(30) Priority: **04.11.1998 IT UD980190**

(43) Date of publication of application:
29.08.2001 Bulletin 2001/35

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(73) Proprietor: **Danieli & C. Officine Meccaniche SpA**
33042 Buttrio (Udine) (IT)

(56) References cited:
DE-A- 3 150 319 **DE-A- 3 404 893**
DE-B- 1 265 525 **US-A- 3 945 585**
US-A- 4 664 329

(72) Inventors:
• **BORDIGNON, Giuseppe**
I-33050 Bicinicco (IT)

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 126 934 B1

Description

FIELD OF THE INVENTION

[0001] This invention concerns a coiling machine for rolled stock, particularly bars, plate, or rods (smooth or ribbed) of hot-rolled metal material, with a cross-section either round, square, rectangular, hexagonal or otherwise.

[0002] To be more exact, the invention concerns a coiling machine located downstream of a traditional rolling train, equipped with drawing rollers and shears, wherein the rolled stock is wound into spirals to form coils which are subsequently tied to be stored or moved.

BACKGROUND OF THE INVENTION

[0003] Coiling machines which are known to the state of the art are substantially divided into two categories, according to whether the axis of rotation of the mandrel or reel is vertical or horizontal.

[0004] Coiling machines with a vertical axis of rotation are based mainly on coiling inside containing cylinders, where the spirals are formed with the help of spiral-forming tools equipped with relative motion with respect to the containing cylinder.

[0005] This type of coiling machine generally does not ensure that a compact coil is formed, since the reciprocal movement of the spiral-forming tool and the containing cylinder is quite uncontrolled and since the stock which is being coiled is not subjected to a controlled tension.

[0006] Coiling machines with a horizontal axis of rotation normally allow to obtain much more compact coils, since the product to be coiled is wound on the central mandrel, which is made to rotate by a motor organ. In such coiling machines, the coil is made by means of successive, superimposed rings or layers, which are coaxial to the reel, and thus compact coils are obtained.

[0007] DE-A-3.150.319 discloses a coiling machine for rolled stock locatable downstream of a rolling train, comprising a mandrel cantilevered mounted rotary around an axis of rotation on a stationary structure and comprising an inner wall orthogonal to the axis of rotation and an outer end.

[0008] The state of the art includes a coiling machine wherein a curved element is arranged inside a containing cylinder, in which the spirals are formed and accumulate, and is kept substantially parallel to the inner surface of the containing cylinder.

[0009] In this coiling machine, while the containing cylinder is made to rotate, the curved element is made to gradually advance, parallel to the axis of rotation of the cylinder, and is removed from inside the coil when the latter has been completed.

[0010] Although this coiling machine is equipped with a device which facilitates the formation of the spirals of the coil, it does not ensure that a compact coil is formed,

since the reciprocal movement of the spiral-forming tool and the containing cylinder is quite uncontrolled and since the stock which is being coiled is not subjected to a controlled tension.

[0011] The state of the art also includes a coiling machine located at the end of a rolling plant for the continuous production of iron bars, wire or round pieces, wherein a single plane product, obtained during a first rolling step, is sub-divided into a plurality of profiles which are given the desired shape in subsequent rolling operations. In this plant the rolled products thus obtained are conveyed, parallel to each other, towards the stationary coiling machine with a horizontal axis of rotation, which provides to coil them simultaneously, or in parallel, so as to form a plurality of coils on the same mandrel.

[0012] This coiling machine has the disadvantage that several profiles, which may even be different from each other, are wound onto the same mandrel, rotating at a set angular velocity, and therefore the coil formed is neither compact nor in the least controlled while it is being formed.

[0013] Moreover, coiling machines which are known to the state of the art do not guarantee a uniform temperature over the whole stock which has been rolled and coiled, with differences at the leading and trailing end and the centre; this gives a lack of uniformity of the metallurgical aspect over the whole coil of rolled stock.

[0014] The present applicant has designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to obtain further advantages.

SUMMARY OF THE INVENTION

[0015] The coiling machine according to this invention is set forth and characterised in the main claim, while the dependent claims describe other characteristics of the main embodiment.

[0016] The main purpose of the invention is to achieve a precision coiling machine, that is to say of the type in which the individual spirals are formed under the guidance of mechanical means which regulate their packing, their density and their tension, and wherein it is very easy and quick to remove the coil of rolled stock as soon as it has been formed.

[0017] In accordance with this purpose, the coiling machine according to the invention comprises a mandrel mounted rotatable and cantilevered, around its axis of rotation, on a stationary structure; the mandrel comprises an inner wall orthogonal to the axis of rotation and has an outer end with which a cylindrical plate is suitable to cooperate selectively; the latter is movable from a working position, wherein it is arranged substantially orthogonal to the axis of rotation so as to define a lateral wall parallel to the inner wall, so as to allow the coil of rolled stock to form, and an inactive position, wherein it is distanced and lowered with respect to the mandrel so

as to allow the coil of rolled stock to be axially removed.

[0018] The coiling machine according to the invention is suitable to coil hot rolled stock of any type, such as bars, plate, or rods (smooth or ribbed) of metallic material, such as low, medium or high carbon steels, stainless steels, alloys or otherwise, with a cross section which may be round, square, rectangular, hexagonal or otherwise, with diameters of between 8 and 52 mm or, in the case of bars or plate, with a section of between 60 mm² (for example 20 mm by 3 mm) and 1400 mm² (for example 70 mm by 20 mm).

[0019] It is thus possible to coil rolled stock travelling at speeds of up to 40 meters per second and more, with a very high hourly production, in the order of about 100-110 tonnes per hour.

[0020] Another purpose of the invention is to provide a coiling machine which will facilitate the formation of the first spirals of rolled stock to be coiled around the reel.

[0021] Another purpose of the invention is to achieve a coiling machine wherein, for each coiling machine, means are provided to maintain the coil uniformly compact, so as to guarantee uniformity of temperature and of metallurgical features over the whole rolled and coiled stock, without appreciable differences between the leading end, the centre, and the trailing end thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other characteristics of the invention will become clear from the following description of a preferred form of embodiment, given as a non-restrictive example, wherein:

- Fig. 1 is a view from above, in diagram form, of a coiling line using a coiling machine according to the invention;
- Fig. 2 is a prospective view of the coiling machine according to the invention, in a working position; and
- Fig. 3 is a prospective view of the coiling machine according to the invention, in an inactive position or a position wherein the coil is removed.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0023] With reference to Fig. 1, a coiling machine 10 according to the invention is suitable to be arranged downstream of a rolling train 11 to coil the rolled stock 12 emerging therefrom.

[0024] The rolling train 11 can be of any known type, comprising drawing rollers 13, a loop-forming device 15 and a shears 16 which is suitable to shear to size the rolled stock 12 to be coiled.

[0025] The looper 15 is suitable to regulate the flow of rolled stock 12 towards the coiling machine 10 and to make it correctly perform the increase in diameter step,

during the same coiling operation. The looper 15 thus fulfils a function of a buffer for the rolled stock 12 before it is coiled.

[0026] The coiling machine 10 comprises a mandrel or reel 20 with a horizontal axis of rotation 21 (Fig. 3), mounted cantilevered and rotatable on a vertical turret 22 of a stationary metallic structure 23.

[0027] The mandrel 20 comprises four elements 25 arranged radially at 90° with respect to each other so as to form a cylindrical surface; the four elements 25 are retractable radially so as to facilitate the removal of the just-formed coil of rolled stock 12. The radial movement of the four elements 25 is obtained with a hydraulically commanded and water cooled mechanism 26.

[0028] The inner part of the mandrel 20 comprises a cylindrical wall 24, orthogonal to the axis of rotation 21, which defines one of the lateral walls between which the coil of rolled stock 12 is formed.

[0029] The mandrel 20 is made to rotate selectively around the axis 21, by an electric motor 27 (Fig. 1), by means of a reduction unit which is arranged inside the turret 22 and which has special gears with helical teeth with a suitable ratio for high speeds.

[0030] A cylindrical containing plate 29 is suitable to cooperate with the outer end of the mandrel 20; the cylindrical plate 29 is mounted rotatable and cantilevered on one end 30 of an arm 31, the other end of which pivots on two blocks 32 of the stationary structure 23.

[0031] The outer end of the mandrel 20 is conical in shape and is suitable to be inserted in a corresponding central seating 38, also conical, of the plate 29, so as to achieve a coupling between the mandrel 20 and the plate 29.

[0032] The cylindrical plate 29 can move between a working position (Fig. 2), wherein it is arranged substantially orthogonal to the axis of rotation 21 of the mandrel 20 and cooperating therewith so as to define the second lateral wall between which the coil of rolled stock 12 is formed, and an inactive position, or position wherein the coil is removed (Fig. 3), wherein it is distanced and lowered with respect to the mandrel 20 and arranged substantially horizontal.

[0033] In order to take the plate 29 from the working position to the inactive position and vice versa, a command is given by an actuation organ 33 by means of a transmission shaft 35.

[0034] On the upper part of the command organ 33 a protective screen 36 is mounted.

[0035] The coiling machine 10 also comprises a device 37 suitable to facilitate the formation of the first spirals of the coil of rolled stock 12 on the mandrel 20.

[0036] The device 37 comprises two guides 39 and 40, substantially semi-cylindrical in shape, hollow inside and arranged one above the other below the mandrel 20. Each guide 39 and 40 has an inner profile mating with the cylindrical outer surface of the mandrel 20 and pivots on the vertical turret 22 of the stationary structure 23.

[0037] The upper guide 39 is provided with a mouth 41 through which the rolled stock 12 is suitable to enter into the inner cavities of the guides 39 and 40 to be guided in the coiling step during the first revolutions of the mandrel 20.

[0038] Two hydraulic actuators 42 and 43 are suitable to simultaneously command the movement of the guides 39 and respectively 40 to take them from a substantially vertical working position (Fig. 2), wherein they are arranged around the mandrel 20 to guide the rolled stock 12, to a substantially horizontal inactive position (Fig. 3), wherein they are distant from the mandrel 20 and outside the space occupied by the coil which is forming on the mandrel 20 itself.

[0039] All the parts which come into contact with the rolled stock 12, like the elements 25 of the mandrel 20, the inner wall 24, the cylindrical plate 29 and the guides 39 and 40, are made of wear-resistant materials.

[0040] The coiling machine 10 also comprises a device to distribute the spirals 45 (Fig. 1), arranged between the looper 15 and the mandrel 20.

[0041] The distributor 45 comprises a tubular guide 46, about 5.5 metres long and with one end 47 pivoting on the base and one end 48 mounted on a distribution trolley 49 which is movable horizontally, commanded by an electric motor which is not shown in the drawings.

[0042] In the inactive position the tubular guide 46 lies on a plane substantially tangent to the outer cylindrical surface of the mandrel 20.

[0043] The end 48 of the guide 46 is also movable vertically on the trolley 49 so that it can pass from one ring of spirals to the following one with a larger diameter and thus perform the increase in diameter step within the same coiling cycle. A balancing device of a pneumatic type, which is not shown in the drawings, is connected to the end 48 of the guide 46 to facilitate the increase in diameter step and the variation thereof during coiling.

[0044] A coil-handling assembly 50 is associated with the mandrel 20 and is suitable to remove the coil of rolled stock 12 as soon as it is formed around the mandrel 20 and to position it on an assembly 51 to transport the coil, located downstream thereof.

[0045] The coil-handling assembly 50 comprises a supporting frame 52, on which four idler rollers 53 are rotatably assembled, parallel to each other, to contain the spirals of the coil; they are suitable to cooperate with the trailing end of the rolled stock 12 during the final step as it is coiled onto the mandrel 20.

[0046] The coiling machine as described heretofore functions as follows:

[0047] In the initial working position the coiling machine 10 is pre-arranged to receive the rolled stock 12 which is to be coiled. To be more exact, the cylindrical plate 29 is positioned in contact with the outer end of the mandrel 20 (Fig. 2) and the semi-cylindrical guides 39 and 40 are arranged in a vertical position, around the mandrel 20.

[0048] The mandrel 20 and with it the cylindrical plate

29 are made to rotate by the motor 27 (Fig. 1).

[0049] The rolled stock 12 arriving from the rolling train 11 is drawn by the drawing rollers 13 at a very high speed, more than 40 metres per second, towards the coiling machine 10 and the device 45 to distribute the spirals guides the leading end of the rolled stock 12 towards the mouth 41 of the guide 39.

[0050] The inner cavities of the guides 39 and 40 facilitate the formation of the first two or three spirals on the mandrel 20, after which the actuators 42 and 43 are activated and the guides 39 and 40 move away from the mandrel 20, rotating by about 90°.

[0051] The rollers 13 of the looper 15 guarantee that the rolled stock 12 is kept under tension and that it is coiled under traction onto the mandrel 20 of the coiling machine 10. They also form the loop needed to accumulate rolled stock 12 to be supplied quickly to the coiling machine 10 as the diameters of the coil are increased during the same coiling cycle. The drawing rollers 13 brake the trailing end of the rolled stock 12, to keep it at the desired tension when the mandrel 20 decelerates and stops at the end of the coiling step.

[0052] The rolled stock 12 is then guided by the tubular guide 46 which is displaced horizontally, backwards and forwards by the trolley 49 and upwards at the end of every ring of spirals. It is thus possible to obtain a rational and controlled distribution of the spirals both on every single ring and also on the different coaxial rings which form the coil.

[0053] With every ring of spirals the mandrel 20 is made to rotate by the motor 27 at a speed temporarily below that of the drawing rollers 13 of the looper 15. The rolled stock 12 is released by the looper 15 at the moment when one ring of spirals is completed and the subsequent ring is started. At this moment the peripheral coiling speed increases in ratio to the change of diameter and the motor 27 adapts its angular speed.

[0054] The speed of rotation of the mandrel 20 is controlled by the loop formed by the looper 15, by means of a rotary probe and the motor 27 is torque controlled, and therefore guarantees at every moment the desired coiling traction, irrespective of the speed of the rolled stock 12.

[0055] Layer after layer, or ring after ring, the coil is formed until the rolled stock 12 has been completely coiled.

[0056] The shears 16 is commanded to shear to size the rolled stock 12 which is coiling on the coiling machine 10, in such a way that the dimensions and weight of the coil are pre-defined.

[0057] While the last spirals are forming, the motor 27 is rapidly decelerated, so that the mandrel 20 stops in a very short time.

[0058] During this deceleration step, when the speed of rotation is low and before the trailing end of the rolled stock 12 emerges from the rollers of the drawing assembly 13 located upstream of the spiral distributor 45, the cylindrical plate 29 is distanced from the mandrel 20 by

the actuation organ 33 and the handling assembly 50 is taken towards the mandrel 20, with its four idler rollers 53 coaxial to the coil which is just being completed.

[0059] The rollers 53 close on the rotating coil and thus prevent the last spirals of the coil from unravelling. In this way the rollers 53 also collaborate in the final step of coiling the trailing end of the compact coil.

[0060] When the motor 27 has completely stopped and the coil of rolled stock 12 is stationary, the coil is removed horizontally from the mandrel 20, which at the same time is radially retracted, commanded by the mechanism 37.

[0061] It is obvious that modifications and additions may be made to the coiling machine for rolled stock as described heretofore, but these shall remain nonetheless within the scope of the invention as defined by the appended claims.

Claims

1. Coiling machine for rolled stock (12) locatable downstream of a rolling train (11), comprising a mandrel (20) cantilevered mounted rotary around an axis of rotation (21) on a stationary structure (22), said mandrel (20) having an inner wall (24) orthogonal to the axis of rotation (21) and an outer end, the coiling machine being **characterised in that** a cylindrical plate (29) is suitable to selectively cooperate with said outer end, the cylindrical plate (29) being movable between a working position, wherein it is arranged substantially orthogonal to the axis of rotation (21) so as to define a side wall parallel to the inner wall (24), to allow the coil of rolled stock (12) to form, and an inactive position, wherein it is distanced and lowered with respect to the mandrel (20) so as to allow the coil of rolled stock (12) to be axially removed.
2. Coiling machine as in Claim 1, **characterised in that** the mandrel (20) comprises a plurality of elements (25) arranged so as to form a cylindrical surface and radially retractable towards the said axis of rotation (21) to facilitate the removal of the just-formed coil of rolled stock (12).
3. Coiling machine as in Claim 2, **characterised in that** the radial movement of the retractable elements (25) is obtained by a hydraulically commanded and water cooled mechanism (26).
4. Coiling machine as in Claim 1, **characterised in that** the cylindrical plate (29) is mounted cantilevered and rotatable on one end (30) of an arm (31) whose other end pivots on the stationary structure (22) and is commanded by an actuation organ (33).
5. Coiling machine as in Claim 1, **characterised in**

that the outer end of the mandrel (20) is substantially conical in shape and is suitable to be inserted in a corresponding conical central seating (38) of the cylindrical plate (29), so as to achieve a coupling between the mandrel (20) and the plate (29), so that the plate (29) rotates together with the mandrel (20) when the plate (29) is in the working position.

6. Coiling machine as in Claim 1, **characterised in that** the mandrel (20) is made to selectively rotate by an electric motor (27) by means of a reduction unit with gears with helical teeth with an appropriate ratio for high speeds.
7. Coiling machine as in Claim 1, **characterised in that** a device (37) is provided to facilitate the formation of the first spirals of the coil of rolled stock (12) on the mandrel (20), the device (37) comprising two guides (39, 40) substantially semi-cylindrical in shape, hollow inside and arranged one above the other below the mandrel (20), each of the guides (39, 40) having an inner profile mating with the outer cylindrical surface of the mandrel (20).
8. Coiling machine as in Claim 7, **characterised in that** one of the two guides (39) is provided with a mouth (41) through which the rolled stock (12) is suitable to enter the inner cavities of the guides (39, 40) to be guided as it is coiled during the first revolutions of the mandrel (20).
9. Coiling machine as in Claim 7 or 8, **characterised in that** two actuators (42, 43) are suitable to simultaneously command the movement of the two guides (39, 40) to take them from a working position substantially orthogonal to the axis of rotation (21), wherein they are arranged around the mandrel (20) to guide the rolled stock (12), to an inactive position substantially parallel to the axis of rotation (21), wherein they are distant from the mandrel (20) and outside the space occupied by the coil of rolled stock (12).
10. Coiling machine as in Claims 2 and 8, **characterised in that** the parts which are suitable to come into contact with the rolled stock (12), like the retractable elements (25) and the inner wall (24) of the mandrel (20), the cylindrical plate (29) and the guides (39, 40), are all made of wear-resistant materials.
11. Coiling machine as in Claim 1, **characterised in that** a device (45) to distribute the spirals is provided to guide the formation of the spirals of rolled stock (12) onto the mandrel (20), the spiral distributing device (45) comprising a guide organ (46) having at least one end (48) movable on a plane substantially tangent to the outer cylindrical surface

of the mandrel (20).

12. Coiling machine as in Claim 1, **characterised in that** a coil handling assembly (50) is provided to remove the coil of rolled stock (12) just formed around the mandrel (20) and to position it on a coil transport assembly (51).
13. Coiling machine as in Claim 12, **characterised in that** the coil handling assembly (50) comprises a supporting frame (52) on which a plurality of idler rollers (53) are mounted rotatable, parallel to the axis of rotation (21) and suitable to cooperate with the trailing end of the rolled stock (12) during its final phase of coiling onto the mandrel (20) to prevent the spirals of the coil from uncoiling.

Patentansprüche

1. Wickelmaschine für Walzgut (12), die stromab einer Walzstraße (11) gelegen ist, die einen Dorn (20) besitzt, der freitragend und um eine Drehachse (21) drehbar an einem stationären Aufbau (22) gelagert ist, und der Dorn (20) eine zu der Drehachse (21) normale innere Wand (24) sowie ein äußeres Ende besitzt, wobei die Wickelmaschine **dadurch gekennzeichnet ist, dass** eine zylindrische Platte (29) wahlweise mit dem äußeren Ende zusammenwirken kann, die zylindrische Platte (29) zwischen einer Arbeitsposition, in welcher sie im Wesentlichen orthogonal zu der Drehachse (21) angeordnet ist, um eine Seitenwand parallel zu der inneren Wand (24) zu bilden und die Bildung des Coils aus Walzgut zu ermöglichen, und einer inaktiven Position bewegbar ist, in welcher sie bezüglich des Dorns (20) beabstandet und abgesenkt ist, um das axiale Entfernen des Coils aus Walzgut (12) zu erlauben.
2. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der Dorn (20) eine Mehrzahl von Elementen (25) besitzt, welche so angeordnet sind, dass sie eine zylindrische Oberfläche bilden und radial in Richtung der Drehachse (21) einziehbar sind, um das Entfernen eines soeben gebildeten Coils aus Walzgut (12) zu erleichtern.
3. Wickelmaschine nach Anspruch 2, **dadurch gekennzeichnet, dass** die radiale Bewegung der einziehbaren Elemente (25) mittels eines hydraulisch gesteuerten und wassergekühlten Mechanismus (26) erhalten wird.
4. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die zylindrische Platte (29) freitragend und drehbar an einem Ende (30) eines Arms (31) gelagert ist, dessen anderes Ende an

dem stationären Aufbau (22) schwenkbar angelenkt ist, und der durch ein Antriebsorgan (33) betätigt wird.

5. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** das äußere Ende des Dorns (20) im Wesentlichen konische Gestalt aufweist und in einen entsprechenden, konischen und zentralen Sitz (38) der zylindrischen Platte (29) eingesetzt werden kann, sodass eine Kopplung zwischen dem Dorn (20) und der Platte (29) erzielt wird, wodurch die Platte (29) zusammen mit dem Dorn (20) rotiert, wenn sich die Platte (29) in der Arbeitsposition befindet.
6. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der Dorn (20) durch einen Elektromotor (27) mit Hilfe einer Reduziereinheit mit schräg verzahnte Zahnräder aufweisenden Getrieben und einem für hohe Geschwindigkeiten geeigneten Übersetzungsverhältnis selektiv in Drehung versetzt wird.
7. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Einrichtung (37) zum Erleichtern der Bildung der ersten Spiralen des Coils aus Walzgut (12) auf dem Dorn (20) vorgesehen ist, wobei die Einrichtung (37) zwei Führungen (39, 40) besitzt, die im Wesentlichen von halbzyklindrischer Gestalt, innen hohl, und eine oberhalb sowie eine unterhalb des Dorns (20) gelegen sind, und jede der Führungen (39, 40) ein inneres Profil besitzt, welches mit der äußeren zylindrischen Oberfläche des Dorns (20) zusammenpasst.
8. Wickelmaschine nach Anspruch 7, **dadurch gekennzeichnet, dass** eine der zwei Führungen (39) mit einem Mund (41) versehen ist, durch welchen das Walzgut (12) in die inneren Hohlräume der Führungen (39, 40) eintreten kann, damit es während der ersten Umdrehungen des Dorns (20) beim Wickeln geführt ist.
9. Wickelmaschine nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** zwei Antriebe (42, 43) gleichzeitig die Bewegung der beiden Führungen (39, 40) steuern können, um sie von einer Arbeitsposition, im Wesentlichen orthogonal zu der Drehachse (21), in welcher sie zur Führung des Walzgutes (12) um den Dorn (20) herum angeordnet sind, in eine inaktive Position, im Wesentlichen parallel zu der Drehachse (21), zu bringen, in welcher sie sich in Abstand von dem Dorn (20) und außerhalb des von dem Coil aus Walzgut (12) eingenommenen Raumes befinden.
10. Wickelmaschine nach Anspruch 2 und 8, **dadurch gekennzeichnet, dass** alle jene Teile, welche mit

dem Walzgut (12) in Kontakt kommen können, wie die einziehbaren Elemente (25) und die innere Wand (24) des Dorns (20), die zylindrische Platte (24) und die Führungen (39, 40) aus verschleißfesten Materialien hergestellt sind.

11. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Einrichtung (45) zum Verteilen der Spiralen vorgesehen ist, um die Bildung der Spiralen aus Walzgut (12) auf dem Dorn (20) zu leiten, wobei die Spiralenverteilungseinrichtung (45) ein Führungsorgan (46) besitzt, bei dem zumindest ein Ende (48) auf einer im Wesentlichen tangential zu der äußeren zylindrischen Oberfläche des Dorns (20) gelegenen Ebene bewegbar ist.
12. Wickeleinrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Coil-Fördereinheit (50) vorgesehen ist, um den soeben auf dem Dorn (20) gebildeten Coil aus Walzgut (12) zu entfernen und ihn auf eine Coil-Transporteinheit (51) zu setzen.
13. Wickelmaschine nach Anspruch 12, **dadurch gekennzeichnet, dass** die Coil-Fördereinheit (50) einen Tragerahmen (52) besitzt, auf dem eine Mehrzahl von Mittlaufwalzen (53) parallel zu der Drehachse (21) drehbar gelagert sind, und die während der Endphase des Wickelns auf den Dorn (20) mit dem Schwanzende des Walzgutes (12) zusammenwirken können, um ein Auseinanderwickeln der Spiralen des Coils zu verhindern.

Revendications

1. Machine à bobiner pour produit laminé (12) localisable en aval d'un train de laminage (11), comprenant un mandrin (20) monté rotatif en porte-à-faux autour d'un axe de rotation (21) sur une structure stationnaire (22), ledit mandrin (20) ayant une paroi intérieure (24) perpendiculaire à l'axe de rotation (21) et une extrémité externe, la machine à bobiner étant **caractérisée en ce qu'un** plateau cylindrique (29) est conçu pour coopérer sélectivement avec ladite extrémité externe, le plateau cylindrique (29) étant mobile entre une position opérationnelle, où il est essentiellement disposé perpendiculaire à l'axe de rotation (21) afin de définir une paroi latérale parallèle à la paroi intérieure (24), pour permettre à l'enroulement du produit laminé (12) d'être réalisé, et une position inactive, dans laquelle il est écarté et abaissé par rapport au mandrin (20) afin de permettre à l'enroulement du produit laminé (12) d'être extrait axialement.
2. Machine à bobiner selon la revendication 1, **caractérisée en ce que** le mandrin (20) comprend une pluralité d'éléments (25) disposés de manière

à former une surface cylindrique et radialement escamotable vers ledit axe de rotation (21) afin de faciliter la dépose de l'enroulement du produit laminé (12) juste réalisé.

3. Machine à bobiner selon la revendication 2, **caractérisée en ce que** le mouvement radial des éléments escamotables (25) est obtenu par l'intermédiaire d'un mécanisme (26) à commande hydraulique et refroidi par eau.
4. Machine à bobiner selon la revendication 1, **caractérisée en ce que** le plateau cylindrique (29) est en porte-à-faux et monté rotatif sur une extrémité (30) d'un bras (31) dont l'autre extrémité pivote sur la structure stationnaire (22) et est commandé par un dispositif d'entraînement (33).
5. Machine à bobiner selon la revendication 1, **caractérisée en ce que** l'extrémité externe du mandrin (20) est essentiellement de forme conique et est conçue pour être insérée dans un palier central conique correspondant (38) du plateau cylindrique (29), afin de réaliser un accouplement entre le mandrin (20) et la plateau (29), de sorte que le plateau (29) tourne avec le mandrin (20) quand la plateau (29) est en position opérationnelle.
6. Machine à bobiner selon la revendication 1, **caractérisée en ce que** le mandrin (20) est conçu pour tourner sélectivement par l'intermédiaire d'un moteur électrique (27) au moyen d'un ensemble réducteur à engrenages à denture hélicoïdale avec un rapport approprié pour des vitesses élevées.
7. Machine à bobiner selon la revendication 1, **caractérisée en ce qu'un** dispositif (37) est conçu pour faciliter la formation des premières spires de l'enroulement du produit laminé (12) sur le mandrin (20), le dispositif (37) comprenant deux guides (39, 40) essentiellement de forme semi-cylindrique, la cavité intérieure disposée au-dessus de l'autre en dessous du mandrin (20), chacun des guides (39, 40) ayant un profil intérieur associé à la surface cylindrique externe du mandrin (20).
8. Machine à bobiner selon la revendication 7, **caractérisée en ce qu'un** des deux guides (39) est équipée d'une embouchure (41) au travers de laquelle le produit laminé (12) peut pénétrer dans les cavités intérieures des guides (39, 40) pour être guidé lors du bobinage durant les premières révolutions du mandrin (20).
9. Machine à bobiner selon la revendication 7 ou 8, **caractérisé en ce que** deux vérins (42, 43) contribuent simultanément à la commande du mouvement des deux guides (39, 40) pour les disposer

d'une position opérationnelle essentiellement perpendiculaire à l'axe de rotation (21), dans laquelle ils sont disposés autour du mandrin (20) pour guider le produit laminé (12), à une position inactive essentiellement parallèle à l'axe de rotation (21), dans laquelle ils sont éloignés du mandrin (20) et à l'extérieur de l'espace occupé par l'enroulement du produit laminé (12). 5

10. Machine à bobiner selon les revendications 2 et 8, 10
caractérisé en ce que les pièces qui sont conçues pour entrer en contact avec le produit laminé (12), comme les éléments escamotables (25) et la paroi intérieure (24), le mandrin (20), le plateau cylindrique (29) et les guides (39, 40), sont toutes réalisées 15
en matériaux résistants à l'usure.

11. Machine à bobiner selon la revendication 1, 20
caractérisée en ce qu'un dispositif (45) pour distribuer les spires est conçu pour guider la formation des spires du produit laminé (12) sur le mandrin (20), le dispositif de distribution des spires (45) comprenant un organe de guidage (46) étant mobile au moins à une extrémité (48) dans un plan essentiellement tangent à la surface cylindrique externe du mandrin (20). 25

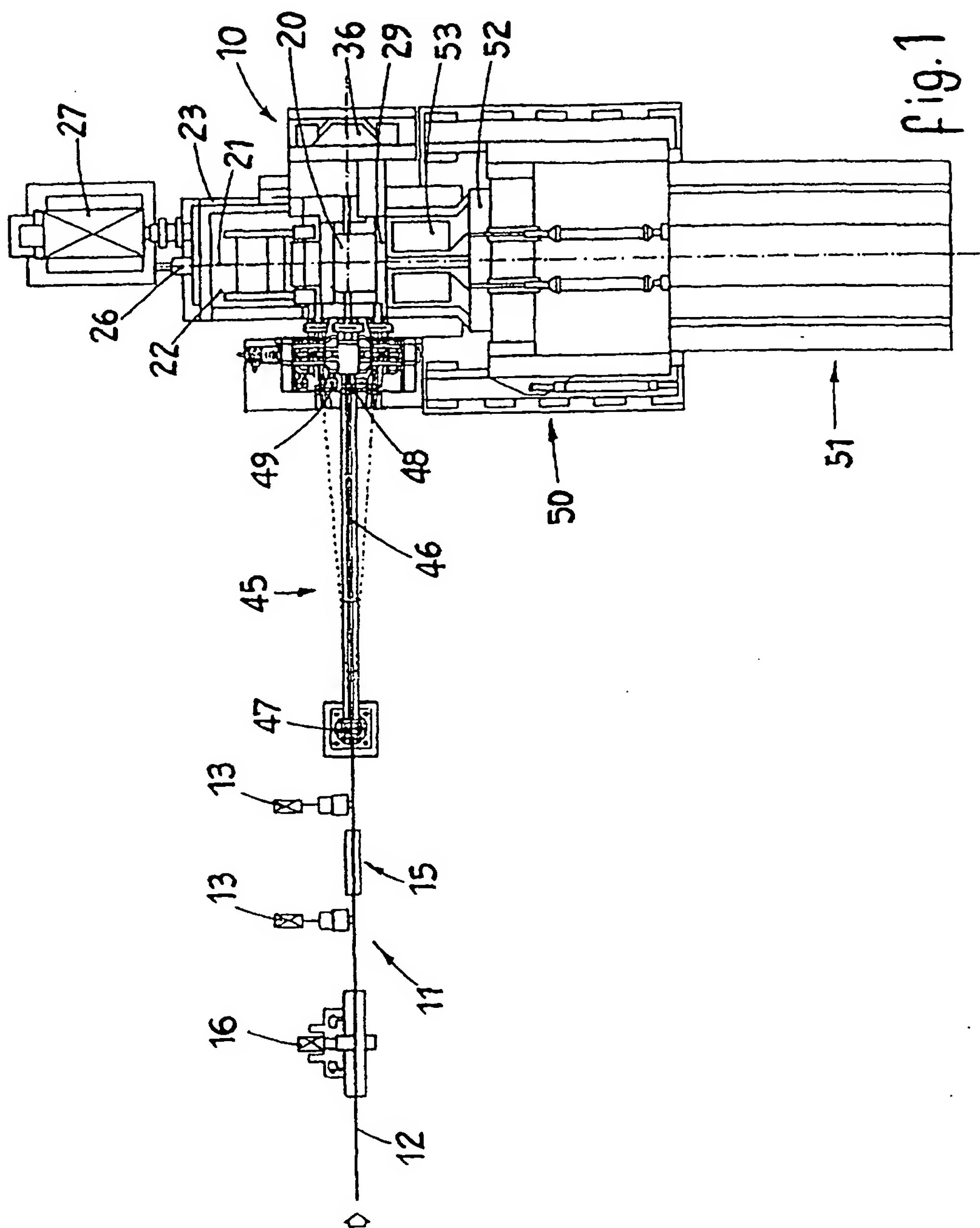
12. Machine à bobiner selon la revendication 1, 30
caractérisée en ce qu'un ensemble support de bobine (50) est conçu pour extraire l'enroulement du produit laminé (12) juste réalisé autour du mandrin (20) et pour le positionner sur un dispositif de transport d'enroulement (51).

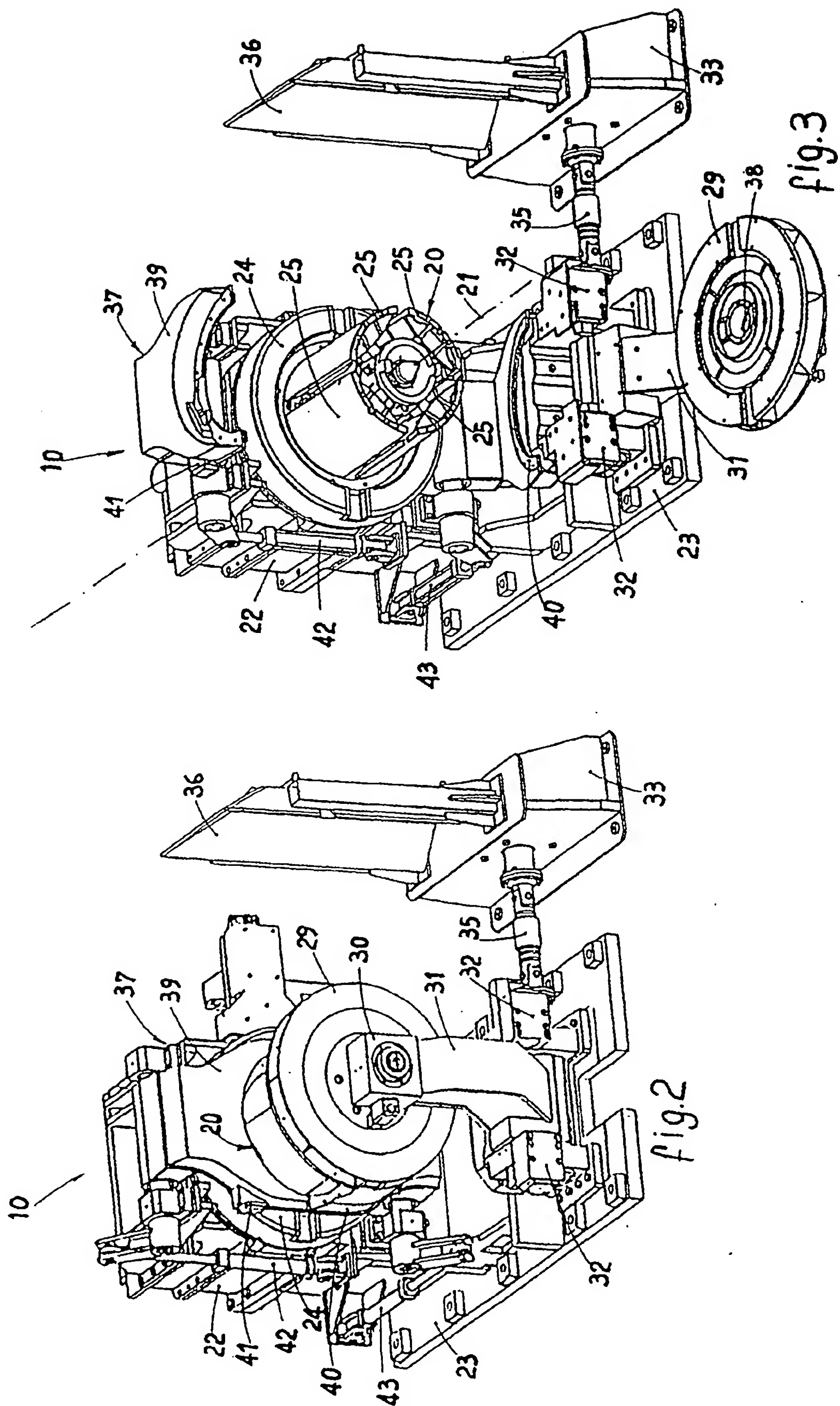
13. Machine à bobiner selon la revendication 12, 35
caractérisée en ce que le support de bobine (50) comprend un bâti support (52) sur lequel une pluralité de rouleaux fous (53) sont montés rotatifs, parallèles à l'axe de rotation (21) et conçus pour coopérer avec l'extrémité de queue du produit laminé (12) pendant sa phase finale de bobinage sur le mandrin (20) pour empêcher les spires de l'enroulement de se défaire. 40

45

50

55





**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.